Outbreak Investigation Video Series
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https://www.youtube.com/playlist?list=PLvgkamPnkczlPMSlXhNfqaW4KcFWyoW9q

Transcript, Video 1: Epidemiological Investigation

The Centers for Disease Control and Prevention defines an outbreak as a sudden increase in the number of cases of a disease above what is normally expected in that population in that area. Unlike an "epidemic", with which "outbreak" shares its definition, the latter typically occurs over a limited geographic area. According to this definition, an outbreak does not necessarily need to reach an epic magnitude that could be depicted in a Hollywood blockbuster movie. In fact, even a couple of cases linked to a common source could constitute an outbreak. Here, we will discuss how to detect an outbreak of a food- or water-borne illness and how to go about identifying its source. Conducting an investigation of an outbreak is typically done by epidemiologists, medical or public health professionals. However, citizen-scientists also have an important role to play in outbreak investigations.

As a citizen-scientist, you should consider signing up for and using grocery store loyalty programs – many grocery stores use the associated information to notify customers of recalled products as well as to track outbreaks. If you are not a member of a loyalty program, hold on to your receipts for at least a couple of weeks. Keep track of your daily habits, foods you eat and restaurants you attend. When outbreaks do occur, consider signing up for the trace-back investigations, even if you did not experience any symptoms. As you will learn throughout this exercise, the success of an outbreak investigation depends to a great extent on having appropriate controls to narrow down potential causes of an outbreak.

If you are in a position to investigate an outbreak, realize that there are several important steps that need to take place:

First, you need to establish whether patients, all seemingly suffering from the same malaise, are a part of an outbreak. Typically, this is done through questionnaires, epidemiological surveys and analysis of other data, for example data obtained from health care providers. If available, data on absenteeism from schools or employers could also be quite useful.

Second, you will need to identify the pathogen (or a toxin) responsible for the outbreak as quickly as possible in order to start treatment of the patients and contain the outbreak.

Third, in parallel with identifying the pathogen (or a toxin) responsible for the outbreak, it is important to determine the source of the pathogen.

Once the pathogen and its source are identified, it will be important to treat the existing patients, contain the outbreak and mount a robust public outreach and education campaign. Depending on the nature of the outbreak, the pathogen (or toxin) and its source, treatment, containment and public outreach campaigns will differ.

Conducting an epidemiological survey is the first step in any outbreak investigation. Once you start seeing patients presenting the same symptoms, develop a questionnaire to obtain both qualitative and quantitative data. Analyze the symptoms, and keep in mind that not all patients will report the same symptoms. Are these symptoms indicative of a food- or water-borne pathogen? If so, try to determine whether patients have something in common.

[Investigator] Have you guys eaten any of the same foods? Or attended the same event? Do you live or work the in the same geographic area? Do you rely on the same was source, or do you have any underlying conditions that can predispose you to various pathogens?

As soon as you begin your investigation, in addition to collecting stool (and sometimes blood) samples of your patients, you should consider asking them to hold on to items in their pantries and refrigerators. Samples of left-over foods will be a treasure-trove.

Your investigation will almost certainly end up being at least a two-step process requiring follow-ups. Once you obtain answers to your original open-ended questions, you will be able to formulate more specific questions requiring "yes" or "no" answers. A question "did you eat at a fast food restaurant last week?" would be an example of an open ended question that you would ask of patients in an outbreak. Suppose 5 of them recall having had breakfast and lunch at a Restaurant Chain A, 4 recall having lunch at the same chain and also at the Chain B, and 7 more recall having breakfasts at both Chains A and B, with another 11 patients having no recollections of attending any of the restaurants associated with these chains. At this point it will be prudent to look into the breakfast and lunch menus at these locations to narrow down the cause and potentially identify something that those who ate at the fast-food restaurants had in common with the other 11 patients who did not. Given that Chains A and B use cheese from the same supplier in their breakfast and lunch menus, and they also rely on water from the same municipal water supply, you can formulate "yes/no" questions such as "Have you consumed cheese during the last week?", "Did you drink tap water during the last week?". You can use these yes/no answers in your follow-up surveys, and you will ask the same questions of both patients and your control groups.

Consider relying on the power of social media for the follow-ups or place phone calls to your original patients. It is absolutely critical that in addition to your original patients, you involve a broadly representative control group: their answers to your narrow "yes" or "no" questions will help you narrow down potential sources of the outbreak. If possible, attempt to collect stool, (possibly blood) and left-over food samples from your control groups. They could be quite important in your investigation, even if the members of your control group never develop the symptoms of the disease.

Keep in mind, that no two humans are alike in their response to pathogens: infectious doses depend on susceptibility of individuals to pathogens and the severity of symptoms varies greatly depending on a number of factors. These factors include biological characteristics of the pathogen, the type and amount of food with which the pathogen was consumed, health status and age of the patient, patients' previous exposure to the pathogen and immunizations, just to name a few.

Determining whether a pathogen is contagious, -or - in other words, transmitted from person to person, is also an important focus of your investigation. Consider asking whether members of the household, other friends, family members and contacts succumbed to infections at later dates.

Once you have obtained the first set of data, analyze it to determine whether you can establish a common source of the pathogen and whether the pathogen is contagious.

Consider these two examples. The first graph indicates that the outbreak started in late August with a few cases, reaching over 150 cases by early September. However, without reinfections,

the number of cases declined. This is a typical curve for an outbreak caused by a pathogen that is not transmitted human to human directly.

The second graph demonstrates that the first wave of the epidemic started with a relatively few cases in mid to late April. However, following an incubation period of approximately seven to ten days, a much larger, second wave of the outbreak took place, followed by a third wave another seven to ten days later.